IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the application of:
HUI-JUNG WU, ET AL.

Docket: 30-4731 (4780) DIV-1

Serial Number: 09/841,453

Group Art Unit: 2829

Filed: April 24, 2001

Examiner: Asok K. Sarkar

For: USE OF MULTIFUNCTIONAL SI-BASED OLIGOMER/POLYMER FOR THE SURFACE MODIFICATION OF NANOPOROUS SILICA FILMS

REQUEST FOR RECONSIDERATION OF DECISION

FAX COVER SHEET

TO: Commissioner for Patents
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DATE: June 28, 2006

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Sir:

This Request for Reconsideration is in response to the Decision of the Board Of Patent Appeals And Interferences mailed May 31, 2006. Claim 20 is most representative of the claims on appeal.

> 20. A *nanoporous* silica film produced by a process comprising the steps of reacting a suitable silica film with a composition comprising a surface modification agent, wherein said silica film is present on a substrate and wherein said reaction is conducted under conditions and for a period of time sufficient for said surface modification agent to form a hydrophobic coating on said film and said surface modification agent comprises at least one type of *oligomer or polymer reactive with silanol groups on said silica film*.

This may be visualized graphically as:

C.	SURFACE MODIFICATION AGENT WHICH IS AN OLIGOMER OR POLYMER REACTIVE WITH SILANOL
B.	NANOPOROUS SILICA FILM HAVING SILANOL REACTIVE GROUPS
A.	SUBSTRATE

In the first rejection, claims 2-16, 18-21, and 31-34 are unpatentable under 35 U.S.C. 103 over Jin in view of Grainger and Kotelnikov. The examiner further rejects claims 22-29 under 35 U.S.C. 103 in view of the same three references.

Jin, et al. Is The Closest Prior Art

Jin et al. discloses dielectric materials comprising a porous organic silica dielectric on a surface for semiconductor and microelectronic device manufacture. Jin, et al. employs the same type of nanoporous silica on a substrate as does the Applicant (i.e. layers A and B above). Jin et al.'s pore surfaces may be rendered hydrophobic by rinsing with a *monomeric* material such as hexamethyldisilazane (HMDS). However, as the examiner admits, Jin *fails* to teach a surface modification agent which is an *oligomer or polymer*.

The examiner attempts to fill the deficiencies of Jin by citing Grainger to teach the use of an oligomer/polymer to impart hydrophobicity on a surface. While Grainger obtusely relates to microelectronic devices, it is far afield from the nanoporous silica materials of this invention. Grainger relates to polymers which form flat, ultrathin polymeric films which are bonded onto a substrate surface to thereby impart various useful properties onto the surface. However Grainger fails to teach the formation of a *nanoporous silica film* on a substrate, wherein the pore surfaces of the film are rendered hydrophobic, as required by the present invention. The only mention of porosity in Grainger is where they state that their films can be formed on *substrates* having microporous structures. However, nowhere

does Grainger teach the formation of any sort of *porous film* which is hydrophobized, let alone a *nanoporous silica film* which has been hydrophobized. Applicants urge that the Langmuir-Blodgett technique used by Grainger to form a film *would not* result in the formation of a nanoporous film. In his technique, a coating substance is floated on top of water, and a substrate beneath the water is raised to the surface such that it is coated by the coating substance. It is submitted that this technique would not be useful with the present invention, as it would result in the formation of a flat, continuous film, not a porous film and certainly not having nanoscale porosity.

Further, several key features of the present invention are not taught by Grainger. The present claims require not only that the nanoporous silica film contains silanol groups, but that the hydrophobizing agent is *reactive* with these silanol groups. While the film of Grainger may include a Si molecule within its polymer chain, there is *no teaching* of a polymer having *silanol groups* within the film's polymer at all. Furthermore, there is *no* indication that *any* of the hydrophobizing polymers of Grainger are silanol reactive as required by the present claims. Thus, it is urged that Grainger fails to fill the voids of Jin.

The Examiner next cites Kotelnikov for showing an oligomeric or polymeric surface modification agent. In the parent application rather than citing Jin, the examiner used different art, namely Gnade, et al (U.S. 5,470,802) and Masakara, et al (U.S. 6,037,277), to show this same features as Jin. The examiner then combined Gnade and Masakara with Kotelnikov (RU 2089499) to show an oligomeric or polymeric surface modification agent. However, in both cases the examiner ignored the fact that Kotelnikov is completely non-analogous art. While the present invention pertains to *nanoporous silica film* which is employed in producing microelectronic devices, Kotelnikov relates to the oil and gas industry.

It should be noted that this was the basis for the Board's overruling of the rejections in parent case serial number 09/488,075 (Appeal No. 2003-1366). In their decision, the Board stated the following:

> The examiner has determined that "Masakara and Gnade fail to disclose that the surface modification agent is an oligomer or polymer reactive with silinols (sic) on the silica film" (answer, page 3), a feature required by all of appellants' claims. In order to make up for that acknowledged deficiency in the teachings of Masakara or Gnade relative to the here claimed subject matter, the examiner turns to Kotelnikov. In this regard, the *examiner* (answer, page 3) asserts that:
>
> > Kotelnikov et al. disclose a method of producing hydrophobic silica coatings by chemical modification reactions with oligomer or polymer silicon-containing compounds.
> >
> > Therefore, given the substantial teachings of Masakara et al. and Gnade et al. in view of Kotelnikov et al., it would have been obvious to one with ordinary skill in the art at the time of the invention to use a surface modification agent, which is an oligomer or polymer reactive with silinols *(sic)* on the silica film.

The Board stated:

> In the supplemental answer, a further summary of what the examiner regards Kotelnikov to teach regarding the use of an oligomeric or polymeric modification agent is provided. However, the examiner has not identified a particularized suggestion, reason or motivation to combine the applied references.
>
> As pointed out by appellants in the briefs (see, e.g., page 8, first two paragraphs of the brief), the examiner has not identified a reasonable incentive for the proposed modification of either of the primary references based on the applied references' teachings. In this regard, the primary references are concerned with dielectrics including silanol containing silica coatings for semiconductor substrates and the constellation of properties associated therewith and Kotelnikov (pages 2 and 3) is concerned with hydrophobic dispersed substances useful in the oil and gas industry for changing the oil and water permeability of strata. While Kotelnikov is directed to improving hydrophobicity properties of dispersed silica substances for use in the oil and gas industry via surface modification using

> oligomer or polymer silicon—containing compounds (for example, polymethylsilazanes) as a possible fourth component in their method (Kotelnikov, page 8), the examiner has not established that the surface modification oligomer or polymer silicon—containing agents disclosed by Kotelnikov would be useful in the disparate semiconductor manufacturing methods of the primary references while not adversely affecting the properties of the semiconductors. The examiner's effort falls short in failing to establish a particularized suggestion for the proposed modification of the specific primary references ' semiconductor fabrication methods in a manner that would have led one of ordinary skill in the art to arrive at the claimed invention with a reasonable expectation of success in so doing. See In re Rouffet, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) . The examiner has not shown how the other references applied by the examiner in rejecting claims 8, 11—14 and 17 remedy the above-noted shortcomings. It follows that we will not sustain either of the examiner's rejections.

The issues above are substantially the same in the rejections in the instant case. Applicants call upon the Board to follow their decision in the parent case to this application where they decided that Kotelnikov was not combinable with the nanoporous silica reference because it is non-analogous art and only pertains to the oil and gas industry, i.e. for the production of a material for use in oil and gas wells, for changing the oil- and water-permeability of strata formed in such wells. The material formed according to this reference is applied onto elements of oil-gas complexes to increase their resistance to aggressive media, corrosion, icing, and biological growth. This reference clearly does not suggest any applicability to a nanoporous silica film on a substrate, having silanols on said silica film, as required by the present invention. It is respectfully urged that Board's affirmation of the present claim rejections in view of Kotelnikov shows an inconsistency in reasoning, and that the rejection of these claims should be overruled.

Next, with specific regard to claim 17, the examiner has combined Jin, Grainger, and Kotelnikov and additionally applied Burns (U.S. patent 5,750,610). The arguments for Jin, Grainger, and Kotelnikov are repeated from above and apply equally herein. Regarding Burns, this reference fails to teach a film on a substrate and importantly fails to teach or

suggest an *oligomer or polymer* which is reactive with silanol groups on any such silica film. The examiner specifically points to column 7, lines 36-40 of Burns, et al for the proposition that Burns, et al employ oligomers. However, these are not oligomers or polymers but rather *monomers*. In addition, Burns, et al does not teach a nanoporous silica film on a substrate, wherein the surface the silica film is to be hydrophobized. Rather, Burns et al. form a reaction product of a silica with an organosilane and a strong acid in a flask (see examples), to provide a hydrophobized reaction product. Such does not pertain to a coating on a substrate at all, and it is urged that one skilled in the art would not have employed the teachings of Burns in their effort to devise the presently claimed invention.

Claims 2-29 and 31-34 stand rejected for obviousness-type double patenting over claims 1-19 of U.S. patent 6,318,124 (Rutherford et al.) in view of Grainger (U.S. patent 5,686,549) and in further view of Kotelnikov (RU 2089499). It is respectfully submitted that the rejection is not well taken. The arguments against Grainger and Kotelnikov are repeated from above and apply equally here. In particular, it is urged that Grainger fails to teach the formation of porous films at all, fails to provide a film having silanol groups, and fails to disclose a silanol-reactive hydrophobizing agent, as presently required. It is further urged that Kotelnikov is improperly applied non-analogous art, for the reasons stated above.

Rutherford et al. discloses a surface-coated nanoporous silica dielectric film in which a polymeric layer is deposited onto a silica dielectric film on a substrate. Rutherford, et al then may apply a *monomeric* surface modification agent such as those enumerated on column 8, lines 15, et seq. However, none of the claims indicate that their surface modification agent is an *oligomer or polymer* which is *reactive with silanol groups* on a silica film. Such is required by the present claims. Applicants urge that since Rutherford uses completely different surface modification agents from those required by the present claims, that Rutherford's coating materials differ from those of the present invention. Thus, it is urged that Rutherford's claims are *materially different*, and thus *patentably distinct*, from the present claims.

None of the cited references, taken alone or in combination, teaches or suggests the invention claimed by Applicants. For all the above reasons, claims 2-29 and 31-34 are urged to be patentable over the cited references, and the rejections under 35 U.S.C.103 and obviousness-type double patenting should be overruled.

Respectfully submitted,

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I hereby certify that this paper is being facsimile transmitted to the United States Patent and Trademark Office (FAX No. (571) 273-8300) on June 28, 2006.

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